

**UNIVERSITI TEKNOLOGI MARA**

**ACTIVE LOAD AND LOSS  
ALLOCATION IN TRANSMISSION  
LINE VIA IMPROVED CUCKOO  
SEARCH OPTIMIZATION  
TECHNIQUE**

**NUR ATIQA BINTI ABDUL RAHMAN**

Thesis submitted in fulfilment  
of the requirements for the degree of  
**Master of Science**

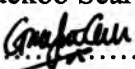
**Faculty of Electrical Engineering**

September 2014

## AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non – academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

Name of Student	:	Nur Atiqah Binti Abdul Rahman
Student I.D. No.	:	2011575287
Programme	:	Master of Science (EE780)
Faculty	:	Electrical Engineering
Thesis Title	:	Active Load and Loss Allocation in Transmission Line via Improved Cuckoo Search Optimization Technique
Signature of Student	:	..... 
Date	:	September 2014

## ABSTRACT

The introduction of deregulation in transmission system has given the opportunity for the end user to choose the supplier. This has brought the importance of active load and loss allocation in transmission line. Due to the nonlinear character of power flow, it is crucial to allocate the losses and active load. Thus, this research has proposed a novel technique to allocate both active load and losses in transmission line using a newly developed Improved Cuckoo Search (ICS) Optimization Technique. In addition, a new objective function has also been proposed in this research to improve the accuracy of the power allocation. The active load and transmission loss allocation have been treated as an optimization problem. In this research, IEEE 5-Bus, Ward-Hale 6-Bus, IEEE 30-Bus and also IEEE 57- Bus systems are used as test systems and a comparative study is conducted with Cuckoo Search (CS) technique and also Genetic Algorithm (GA) technique. In addition, the proposed method with the new objective function is also tested in line outage and load increase conditions. The results are compared in terms of accuracy of the allocation, computational time and also the consistency. From the results and comparative study, the proposed new technique offers an accurate allocation of power among the market participants. Hence, they will be charged fairly for their transmission cost as required in a deregulated power system.

## TABLE OF CONTENTS

	Page
<b>CONFIRMATION BY PANEL OF EXAMINERS</b>	ii
<b>AUTHOR'S DECLARATION</b>	iii
<b>ABSTRACT</b>	iv
<b>ACKNOWLEDGEMENTS</b>	v
<b>TABLE OF CONTENTS</b>	vi
<b>LIST OF TABLES</b>	viii
<b>LIST OF FIGURES</b>	xiii
<b>LIST OF ABBREVIATIONS</b>	xiv
<b>CHAPTER ONE: INTRODUCTION</b>	1
1.1 Background Studies	1
1.2 Problem Statements	3
1.3 Objectives Of The Research	3
1.4 Scope And Limitations Of Research	4
1.5 Significances Of Research	4
1.6 Structure Of Thesis	5
<b>CHAPTER TWO: LITERATURE REVIEW</b>	6
2.1 Introduction	6
2.2 Real Power Flow And Loss Allocation In Transmission Line	6
2.3 Applications Of Nature-Inspired Metaheuristic Algorithms In Real Power Flow And Loss Allocation	9
2.4 Cuckoo Search Algorithm	10
2.5 Cauchy Distribution Based On Mutation Technique	11
2.6 Chapter Conclusion	12
<b>CHAPTER THREE: RESEARCH METHDOLOGY</b>	14
3.1 Introduction	14
3.2 Overall Research Methodology	14
3.3 Development Of Improved Cuckoo Search Algorithm For Power Allocation	

Technique	17
3.4 The Development Of Objective Function	23
3.5 Implementation Of Cs And Ics In Active Load And Loss Allocation	25
3.6 Chapter Conclusion	29
<b>CHAPTER FOUR: RESULT AND DISCUSSION</b>	<b>30</b>
4.1 Introduction	30
4.2 Normal Condition	30
4.2.1 IEEE 5 Bus System	30
4.2.2 Ward Hale 6 Bus System	39
4.2.3 IEEE 30 Bus System	48
4.2.4 IEEE 57 Bus System	61
4.3 Line Outage Condition	65
4.4 Load Increase Condition	71
4.4.1 Condition 1: Increment of Q Load	71
4.4.2 Condition 2: Increment of P Load	77
4.4.3 Condition 3: Increment of P and Q Load	83
4.5 Chapter Conclusion	90
<b>CHAPTER FIVE: OVERALL CONCLUSION AND RECOMMENDATION FOR FUTURE RESEARCH</b>	<b>92</b>
5.1 Conclusion	92
5.2 Recommendation For Future Research	94
<b>REFERENCES</b>	<b>95</b>
<b>AUTHOR'S PROFILE</b>	<b>99</b>